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EXAMINER

DHINGRA, RAKESH KUMAR

ART UNIT	PAPER NUMBER
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1792

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/507,524	Applicant(s) MIYAGAWA, KAZUHISA	
	Examiner Rakesh K. Dhingra	Art Unit 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 November 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
 4a) Of the above claim(s) 4-13 and 15-21 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☐ Claim(s) 1-3 and 14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 September 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>09/04</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 1-3 and 14 have been considered but are moot in view of the new ground(s) of rejection as explained hereunder.

Applicant has amended claim 1 by adding new limitation "said electromagnetic field is generated by said transmission line" and "parallel" and "horizontal and disposed one above the other".

Claims 1-21 are now pending out of which claims 1-3 and 14 are active.

New references by Tobe et al (US Patent No. 5,891,349) and Becker et al (US Patent 6,531,031) when combined with Nobuyuki et al (JP 11-111494) read on amended claim 1 limitations. Accordingly claims 1-3 and 14 have been rejected under 35 USC 103 (a) as explained below.

Further, regarding applicant's argument that twin leads 77-77 of Collins do not generate electromagnetic field to produce plasma, the examiner responds that electromagnetic field is generated by the transmission line conductors 77-77 (claim does not recite that twin leads 77-77 generate electromagnetic field to produce plasma). In view of this, amended claims 1 is rejected under 35 USC 102 (b) as explained below. Balance claims 2, 3, 14 have also been rejected under 35 USC 103 (a) as explained below.

Applicant's argument regarding Nobuyuki not teaching the claim 1 limitation that the transmission line includes two parallel conductors that are horizontal and disposed one above the other is rendered mute since the rejection is withdrawn due to claim amendment.

Further, in view of comments given above regarding teaching of Collins regarding claim 1, the double patenting rejections are maintained.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

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A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 14 are rejected under 35 U.S.C. 102(b) as being anticipated by Collins (US patent No. 5,707,486).

Regarding Claims 1, 14: Collins teaches a plasma processing apparatus (Figures 1, 9-11) comprising:

a vacuum chamber 11 wherein a gas plasma is generated by generating an electromagnetic field so as to treat an object (wafer 5) by the plasma, comprising a balanced transmission line structure 77 that is connected to a high-frequency power supply 27 through a balun 70, and an electromagnetic field is generated by to generate a plasma. Collins also teach the transmission line has a terminal 76 which is used to attain impedance match by connecting to a matching network 28. Additionally, Collins teaches a post 53 (like a terminal) that assists in impedance matching between transmission line structure 77 and the RF source 27. Collins further teach the balanced transmission line 77 comprises two parallel conductors are horizontal and disposed one above the other (transmission line portions marked as 77 in Fig. 1) and the electromagnetic field is generated by the balanced transmission line {col. 6, line 10 to col. 8, line 55 and col. 9, line 55 to col. 10, line 56}.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter

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sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-3, 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tobe et al (US Patent No. 5,891,349) in view of Becker et al (US Patent 6,531,031) and Nobuyuki et al (JP 11-111494).

Regarding Claim 1: Tobe et al teach a plasma processing apparatus that produces gas plasma in a vacuum chamber 20 by generating an electromagnetic field so as to treat an object 21 by plasma, and comprising a coil electrode 61 connected to high frequency power supply 52 through lines 62, 63 (transmission line). Tobe et al further teach that coil 61 can have plural conductors that are parallel, horizontal and disposed one above the other (e.g. Fig. 1, 11A and col. 7, line 65 to col. 8, line 45 and col. 9, lines 32-38).

Tobe et al do not teach that the transmission line is a balanced line having a terminal that is used for impedance matching.

Becker et al teach a plasma apparatus wherein an inductive plasma generating coil 6 is fed high frequency power through balanced transmission lines 40 that are balanced by adjusting impedance using capacitors 24-27 (e.g. Fig. 1-3 and col. 7, line 30 to col. 7, line 45).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to modify the high frequency feed system in the apparatus of Tobe et al by a balanced transmission line structure as taught by Becker et al to obtain uniform plasma and reduced sputtering inside the chamber (Becker et al –col. 3, line 40 to col. 4, line 65).

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Tobe et al in view of Becker et al do not explicitly teach the transmission line has a terminal that is used for impedance matching. However use of a terminal for impedance matching is known in the art as per reference cited hereunder.

Nobuyuki et al teach a plasma apparatus (Figures 1-5) comprising:

a vacuum chamber 1 wherein a gas plasma is generated to treat an object (wafer 10) by the plasma, by an electromagnetic wave supply system comprising a coaxial track 4 and an antenna 5 (making up the transmission line structure) that is connected to high-frequency power supplies 5, 13. Nobuyuki et al further teach that the transmission line structure includes plate 16 (like a terminal) that helps in impedance matching (e.g. Fig. 1, 4 and para. 0014, 0015).

Therefore it would have been obvious to one of skills in the art at the time of the invention to provide a terminal in the transmission line of Tobe et al in view of Becker et al as taught by Nobuyuki et al to enable reduce reflections and couple RF power more efficiently into the plasma chamber.

Regarding claim 2: Tobe et al in view of Becker et al and Nobuyuki et al teach the balanced transmission line is disposed within the vacuum chamber.

Regarding claim 3: Tobe et al teach the gas inlet (from gas source 10) is formed above the transmission line 61 (Fig. 1). Further, Nobuyuki et al also teach that gas inlet 23 is formed above the transmission line (Fig. 4).

Regarding claim 14: Becker et al teach that transmission line 40 is connected to high frequency power supply 23 via a coaxial cable slow wave structure 30 (balun) {col. 3, lines 40-65}.

Claims 2, 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Collins (US patent No. 5,707,486) in view of Nobuyuki et al (JP 11-111494).

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Regarding Claim 2: Collins teaches all limitations of the claim including a balanced transmission line but does not explicitly teach that the balanced transmission line is disposed within the vacuum chamber. However the location of the balanced transmission line being within the vacuum chamber is known in the art as per sample reference cited hereunder.

Nobuyuki et al teach a plasma apparatus (Figures 1-5) comprising:

a vacuum chamber 1 wherein a gas plasma is generated to treat an object (wafer 10) by the plasma, by an electromagnetic wave supply system comprising a coaxial track 4 and an antenna 5 (making up the transmission line structure) disposed within the vacuum chamber and connected to high-frequency power supplies 5, 13. Nobuyuki et al further teach that the transmission line structure includes plate 16 (like a terminal) that helps in impedance matching (e.g. Fig. 1, 4 and para. 0014, 0015).

Therefore it would have been obvious to one of skills in the art at the time of the invention to provide the balanced transmission line inside the vacuum chamber as taught by Nobuyuki et al in the apparatus of Collins to provide power more efficiently into the plasma space.

Regarding Claim 3: Nobuyuki et al also teach that gas inlet 23 is formed above the transmission line (Fig. 4).

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226

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(Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

1) Claim 1 is rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of U.S. Patent No. 6,657,151 in view of Collins (US Patent No. 5,707,486).

Claim 1 of patent teaches a plasma processing apparatus that produces plasma in a vacuum chamber by generating an electromagnetic field so as to treat an object by the plasma, comprising a transmission line that is connected to a high-frequency power supply and that has a short circuited end (terminal thereof) used to attain an impedance match, wherein the two conductors constituting said balanced transmission line are disposed vertically.

Claim 1 of the patent does not teach the transmission line is balanced, and the electromagnetic field is generated by said balanced transmission line, and two parallel conductors constituting said balanced transmission line are horizontal and disposed one above the other.

Collins teaches a plasma processing apparatus (Figures 1, 9-11) comprising:

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a vacuum chamber 11 wherein a gas plasma is generated by generating an electromagnetic field so as to treat an object (wafer 5) by the plasma, comprising a balanced transmission line structure 77 that is connected to a high-frequency power supply 27 and an electromagnetic field is generated by to generate a plasma. Collins also teach the transmission line has a terminal 76 which is used to attain impedance match by connecting to a matching network 28. Additionally, Collins teaches a post 53 (like a terminal) that assists in impedance matching between transmission line structure 77 and the RF source 27. Collins further teach the balanced transmission line 77 comprises two parallel conductors are horizontal and disposed one above the other (transmission line portions marked as 77 in Fig. 1) and the electromagnetic field is generated by the balanced transmission line {col. 6, line 10 to col. 8, line 55 and col. 9, line 55 to col. 10, line 56}.

Therefore it would have been obvious to one of skills in the art at the time of the invention to make the transmission line a balanced transmission line by adding a balun as taught by Collins in the apparatus of Claim 1 of the patent to enable convert the matched power output to a balanced output.

2) Claim 1 is rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 4, 8, 11, 15 of U.S. Patent No. 5,314,603 in view of Collins (US Patent No. 5,707,486).

Claims 1, 4, 8, 11 and 15 of the patent teach a plasma processing apparatus that produces plasma in a vacuum chamber by generating an electromagnetic field so as to treat an object by the plasma, comprising a transmission line that is connected to a high-frequency power supply, wherein the two conductors constituting said balanced transmission line are disposed vertically.

Claims 1, 4, 8, 11 and 15 of the patent do not teach the transmission line is balanced, the transmission line has a terminal for impedance matching, the electromagnetic field is generated by said

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balanced transmission line, and two parallel conductors constituting said balanced transmission line are horizontal and disposed one above the other.

Collins teaches a plasma processing apparatus (Figures 1, 9-11) comprising:

a vacuum chamber 11 wherein a gas plasma is generated by generating an electromagnetic field so as to treat an object (wafer 5) by the plasma, comprising a balanced transmission line structure 77 that is connected to a high-frequency power supply 27 and an electromagnetic field is generated by to generate a plasma. Collins also teach the transmission line has a terminal 76 which is used to attain impedance match by connecting to a matching network 28. Additionally, Collins teaches a post 53 (like a terminal) that assists in impedance matching between transmission line structure 77 and the RF source 27. Collins further teach the balanced transmission line 77 comprises two parallel conductors are horizontal and disposed one above the other (transmission line portions marked as 77 in Fig. 1) and the electromagnetic field is generated by the balanced transmission line {col. 6, line 10 to col. 8, line 55 and col. 9, line 55 to col. 10, line 56}.

Therefore it would have been obvious to one of skills in the art at the time of the invention to make the transmission line a balanced transmission line by adding a balun as taught by Collins in the apparatus of Claim 1 of the patent to enable convert the matched power output to a balanced output and improved plasma density control.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing

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date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rakesh K. Dhingra whose telephone number is (571)-272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Rakesh K. Dhingra



Karla Moore
Primary Examiner
Art Unit 1792